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| **CIVL372 - Fundamentals of Reinforced Concrete**  |
| **Department:** Civil Engineering |
| **Program Name:** Civil Engineering | **Program** **Code:** 22 |
| **Course Number:** CIVL372 | **Credits:**4 Cr |
| [x]  Required Course [ ]  Elective Course  |
| **Prerequisite(s):** CIVL343 |
| **Catalog Description**: Behavior of RC members: Single reinforced beams, double reinforced beams , T-beams, short columns, slender columns. Moment curvature relations of reinforced concrete beams and columns. Torsion in RC members. Bond and anchorage. (Prerequisite: CIVL343) |
| **Course instructors:**Assoc. Prof. Dr. Serhan Şensoy  |
| **Course Web Page:** <https://staff.emu.edu.tr/serhansensoy/en/teaching/CIVL372> |
| **Textbook(s):** 1. Karaboğa, E., Reinforced Concrete I, 2nd Edition, EMU Press, Gazimagusa, 2004
2. Karaboğa, E., Reinforced Concrete II, 2nd Edition, EMU Press, Gazimagusa, 2005
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| **Indicative Basic Reading List :**1. Ersoy, U., Özcebe, G. And Tankut, T., Reinforced Concrete, METU, Ankara 2013
2. Ersoy, U., Reinforced Concrete, METU, Ankara 2000.
3. Celep, Z. Betonarme Yapılar, İhlas Matbaacılık, Beta Dağıtım, İstanbul, 2009. (in Turkish)
4. Betonarme Yapıların Hesap ve Yapım Kuralları, TS 500, Türk Standartları Enstitüsü, 2000.
5. Ferguson, Breen & Jirsa, Reinforced Concrete Fundamentals
6. Nilson A. H., Design of Concrete Structures, McGraw Hill, 1997
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| **Course Outline:**

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| **Week 1****17-21** **Feb 2020** | **Introduction to course and requirements. (5 Classes)**Course objectives, course description. Definition of RC, pre-stressed concrete. Relationship of the course with other courses. |
| **Week 2****24-28** **Feb 2020**  | **Design methods, codes, safety provisions of TS 500. Materials. (5 Classes)**Behavior of RC beams subject to flexure. States of the RC beams from linear elastic to inelastic states. Failure state of RC beams. Safety. Necessity of codes. Safety provisions, load and material strength factors of TS500.  |
| **Week 3****2-6** **March 2020** | **Analysis and design of beams subject to bending. Flexural strength of rectangular beams with tension reinforcement only ( 5 Classes)**Design of single reinforced (tension reinforcement only) of rectangular beams. Other requirements of TS500.  |
| **Week 4****9-13** **March 2020** | **Balanced failure. Beam problems (5 Classes)**Balanced failure and balanced steel ratio for rectangular beams. Rectangular beam problems and design tables and their properties.  |
| **Week 5****16-20** **March 2020** | **Double reinforced rectangular beams (5 Classes)**Behavior of double reinforced rectangular beams. Design and review of double reinforced rectangular beams. |
| **Week 6****23-27** **March 2020** | **Design and review of T-beams (5 Classes)**Behavior, design and review of T-beams and other relevant beams like triangular beams and rectangular beams.  |
| **Week 7****30 March-****3 April 2020****Week 8-9****6-17****April 2020** | **Shear design of beams (5 Classes)**Behavior of RC beams without and with web reinforcement. Design provisions of TS500 for shear. Importance of the web reinforcement. Discussions confined and unconfined reinforced concrete members and their behavior under earthquake excitation.**MIDTERM EXAM WEEK (6-17 Appril 2020)** |
| **Week 10****20-24****April 2020** | **Shear design of beams and Torsion (5 Classes)**Behavior of RC beams without and with web reinforcement. Design provisions of TS500 for shear. Importance of the web reinforcement. Discussions confined and unconfined reinforced concrete members and their behavior under earthquake excitation. Torsion in beams |
| **Week 11****27-30** **April 2020****Week 12-14****4-22****May 2020** | **Bond, anchorage and development length (2 Classes)**Definition of development length. Basic development length for RC members. Practical rules for cut off and bend points.**Behavior and Design of Columns and revision (15 Classes)**Behavior and design of short and slender columns subject to biaxial loading. Moment magnifier method for braced and unbraced columns. |
| **Week 15-16****2-17 Jan 2020** | **Final Examinations** |

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**Quiz Dates:**

 6th of March 2020, Friday at 16:30 Quiz 1

 20th of March 2020, Friday at 16:30 Quiz 2

 8th of May 2020, Friday at 16:30 Quiz 3

 22nd of May 2020, Friday at 16:30 Quiz 4

**Homework Dates:**

HW Work will be announced on 11th of May 2020 and last day for the submission is 31st of May 2020 16:00

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| **Course Learning Outcomes:** At the end of the course the students will be able to: 1. Understand behaviour of concrete and steel in tension and compression.
2. Understand the concepts of design methods and general safety principles
3. Have general idea of safety provisions of TS 500.
4. Understand ultimate flexural strength of rectangular sections
5. Understand the importance of ductility and factors effecting ductility
6. Develop an ability on continuous beam design
7. Understand behaviour of reinforced concrete members subject to both axial load and bending moment
8. Understand principles of bond, anchorage and development length
9. Develop ability to design beams for shear.
10. Develop ability on collaborative study practice and independent learning.
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| **Class Schedule:** 4 hrs of lectures per week  | **Laboratory Schedule:** 1 hr of tutorial/laboratory per week |
| **Assessment** | **Method** | **No** | **Percentage** |
| Midterm Exam(s) | 1 | 30 % |
| Homework | 1 | 10 % |
| Quiz(es) | 3 | 15 % |
| Final Examination | 1 | 45 % |
| **NG Policy**Attendance will be taken every lecture hour by the lecturer. Any student who has poor interest in the course, with poor attendance (less than 70%), with lack of exams (more than one) will be given NG (nil grade). This rule will be followed strictly.**Contribution of Course to Criterion 5**Credit Hours for: Mathematics & Basic Science : 0Engineering Topic and Design : 4 General Education : 0  |
| **Relationship of Course to Student Outcomes**The course makes significant contributions to the following program outcomes:* an ability to apply knowledge of mathematics, science, and engineering,
* an ability to design and conduct experiments, as well as to analyze and interpret data,
* an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
* an ability to function on multidisciplinary teams,
* an ability to identify, formulate, and solve engineering problems,
* an understanding of professional and ethical responsibility,
* an ability to communicate effectively,
* the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context,
* a recognition of the need for, and an ability to engage in life-long learning,
* a knowledge of contemporary issues,
* an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice,
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| **Prepared by: Assoc. Prof. Dr. Serhan Şensoy** | **Date Prepared:** SPRING 2019-2020 |